

HAWAII PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 43*

Fourteenth Progress Report
1 July 2004 through 30 September 2004

Hydrometeorological Design Studies Center
Hydrology Laboratory

Office of Hydrologic Development
U.S. National Weather Service
National Oceanic and Atmospheric Administration
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DISCLAIMER

The data and information presented in this report are provided only to demonstrate current progress on the various technical tasks associated with this project. Values presented herein are NOT intended for any other use beyond the scope of this progress report. Anyone using any data or information presented in this report for any purpose other than for what it was intended does so at their own risk.

Table of Contents

- 1. Introduction 1
- 2. Highlights 3
- 3. Progress in this Reporting Period..... 4
- 4. Issues..... 8
- 5. Projected Schedule and Remaining Tasks..... 8
- References..... 10

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1. Introduction

The Hydrometeorological Design Studies Center (HDSC), Hydrology Laboratory, Office of Hydrologic Development, U.S. National Weather Service is updating its precipitation frequency estimates for Hawaii. Current precipitation frequency estimates for Hawaii are contained in *Technical Paper No. 43*, "Rainfall-Frequency Atlas of the Hawaiian Islands for Areas to 200 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years" (U.S. Weather Bureau 1962). The update includes collecting data and performing quality control, compiling and formatting datasets for analyses, selecting applicable frequency distributions and fitting techniques, analyzing data, mapping and preparing reports and other documentation.

The Project will determine annual precipitation frequencies for durations from 5 minutes to 60 days, for average recurrence intervals from 2 to 1,000 years. The Project will review and process rainfall data for the Project area and use accepted statistical methods. The Project results will be published as a Volume of NOAA Atlas 14 on the internet (<http://www.nws.noaa.gov/ohd/hdsc>) using web pages with the ability to download digital files.

The Project area covers the Hawaiian Islands including Hawaii, Maui, Lanai, Molokai, Oahu, and Kauai. The Project area including preliminary regions is shown in Figure 1.

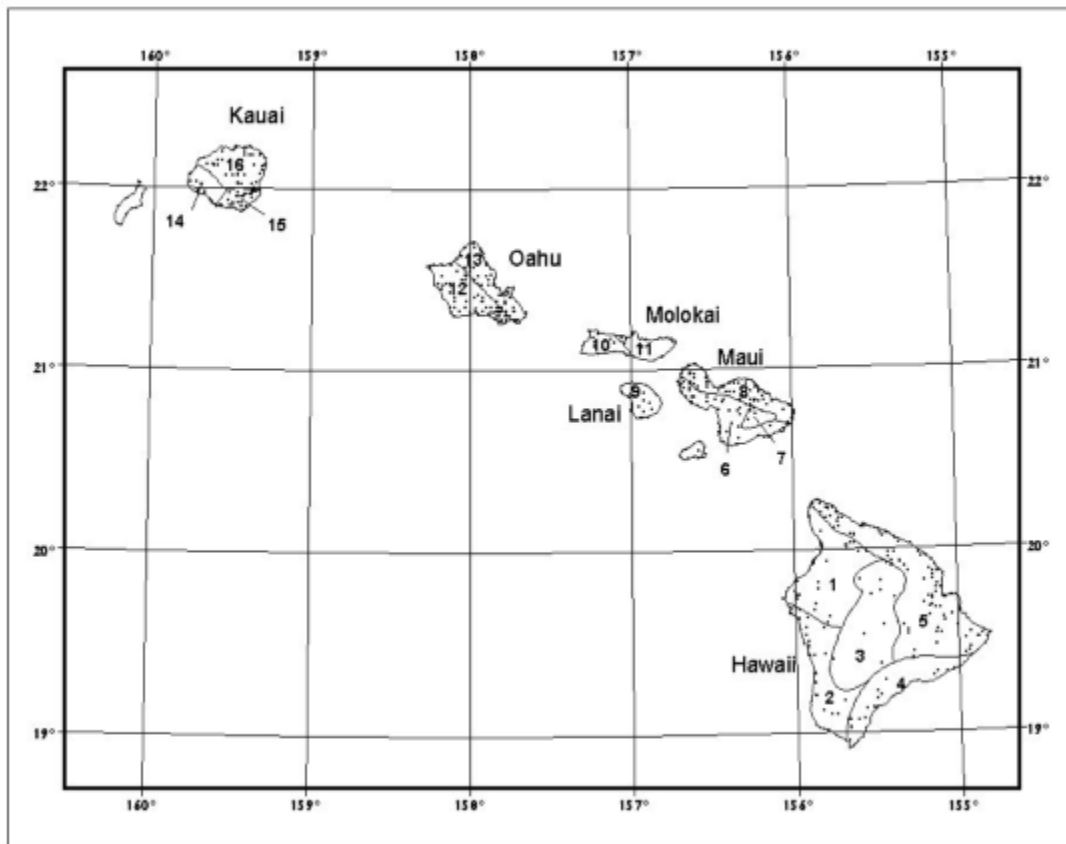


Figure 1. Hawaii Precipitation Frequency Project area, regional divisions and daily station locations.

2. Highlights

Funding has become available for Fiscal Year 2005 (FY05) and therefore it is anticipated that we will be able to start on the Hawaii Precipitation Frequency Project in May 2005. Additional information can be found in Section 4.1, Funding Becomes Available for FY05 and Section 5, Projected Schedule and Remaining Tasks.

Some highlights discussed below are lessons learned from both the Semiarid Southwest project and the Ohio River Basin and Surrounding States project and therefore are relevant to this project.

On September 27th, 2004, HDSC published documentation for NOAA Atlas 14 Volume 1, Precipitation Frequency Estimates for the Semiarid Southwestern United States (Bonnin et al., 2004). It is available at <http://hdsc.nws.noaa.gov/hdsc/>. Documentation for the Hawaii Project will be similar.

The difference between two extraction procedures for the partial duration series (PDS) was examined. It was found that both procedures produced similar results. Additional information is provided in Section 3.1, PDS Extraction.

The Precipitation Frequency Data Server (PFDS), the on-line portal for all NOAA Atlas 14 deliverables and information, underwent several subtle but important changes. Additional information is provided in Section 3.2, PFDS.

Progress continues in the development of geographically-fixed Areal-Reduction-Factor (ARF) curves for basin area sizes of 10 to 400 square miles. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 is 90% complete. An additional study area (Santa Barbara County, CA) has been added and two other study areas (Ventura County, CA and Chickasha, OK) are being considered. There are currently 12 study areas located throughout the conterminous U.S., Hawaii, and Puerto Rico that have been quality controlled, processed and are ready for ARF analysis. Additional information is provided in Section 3.3, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 PDS Extraction

A partial duration series (PDS) is constructed by taking all of the highest cases above a threshold regardless of the year in which the case occurred. For this project, PDS consisted of the N largest cases in the period of record, where N is the number of years in the period of record at the particular observing station. Such a series is also called an annual exceedance series (AES) (Chow et al., 1988). A new extraction procedure for an AES was compared to the current procedure (described below). The difference between the 2 extraction procedures was examined and it was found that both procedures produced similar results.

In the current extraction procedure (AES1), the maximum precipitation for each month was selected and then sorted in descending order for the 1-day and 2-day durations. For longer durations, a pre-defined number of cases were selected in each year and sorted. The highest N values were then extracted from these cases based on the number of actual years of record for that station. However, an alternative extraction procedure (AES2), considers an unlimited number of maxima from each year regardless of month or pre-defined number of cases in each year. The cases for consideration in this procedure were required to be separated by at least one dry day. A comparison showed that precipitation frequency estimates derived from each extraction procedure were not different. In fact, for the 1-day, 7-day and 30-day durations that were tested in all 59 regions in the project area, the AES2/AES1 ratio varied roughly between 0.988 and 1.015.

3.2 Precipitation Frequency Data Server

The Precipitation Frequency Data Server (PFDS) - the on-line portal for all NOAA Atlas 14 deliverables and information - underwent several subtle, but important changes. They include:

1. Several frequently asked questions were added to the FAQ page (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_faq.html)
2. The text on the Seasonality graph axis was changed to be consistent in terminology
3. Updated README file that resides in each of the state- and region-specific anonymous ftp directories
4. Redesigned version table on "GIS Data and Maps" page (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_data.html) making it clearer which version number is associated with which project
5. Updated NA14 documents web page with table and links to the various pdf files representing the difference sections of the draft NOAA Atlas 2 Volume 1 documentation
6. Added Time Series button to state-specific pages

7. Modified state-specific pages without updated data to include links to newly posted scanned documents available via the Current PF Publications page (<http://www.nws.noaa.gov/ohd/hdsc/currentpf.htm>)
8. 5-year and 10-year exceedances were added to the seasonality graphs

HDSC continuously monitors the hits, integrity and performance of the PFDS, which has received an increasing number of hits per month. The graph (Figure 2) below summarizes the number of individual data inquiries made on both the Semiarid Project results and the Ohio Project results, which officially came on-line on June 29th, 2004. The included map (Figure 3) indicates the locations of inquiries during the past quarter.

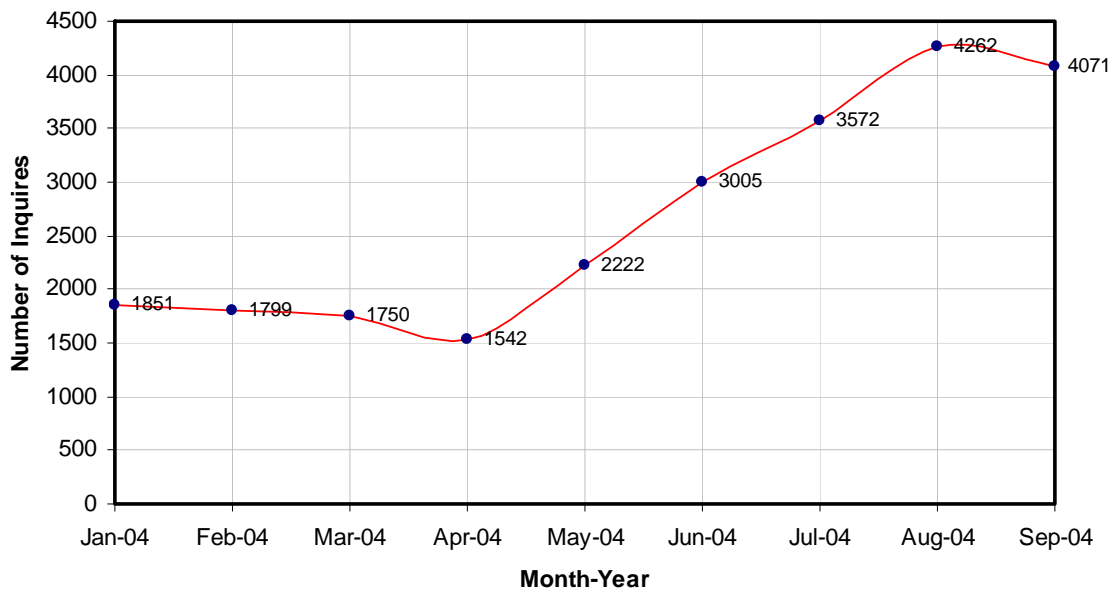


Figure 2: Number of individual PFDS data inquiries per month.

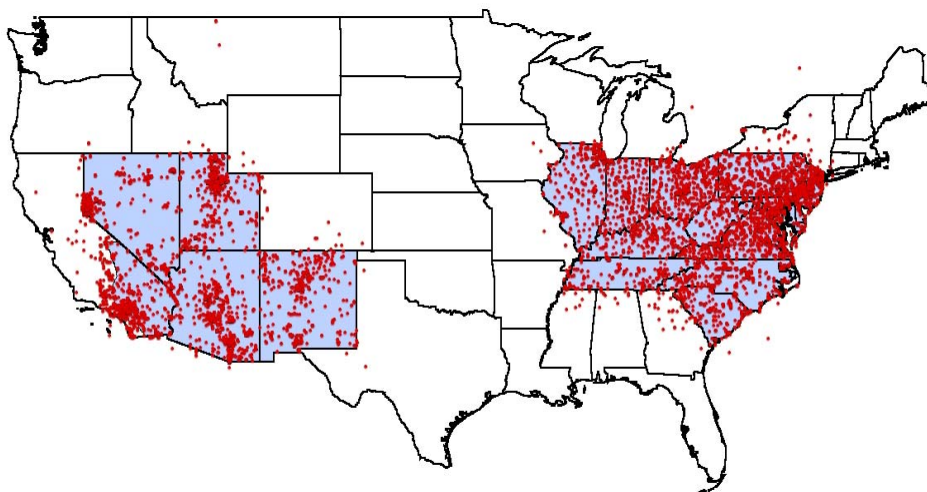


Figure 3: Map of 11,905 PFDS data inquiry locations during the period July-September 2004.

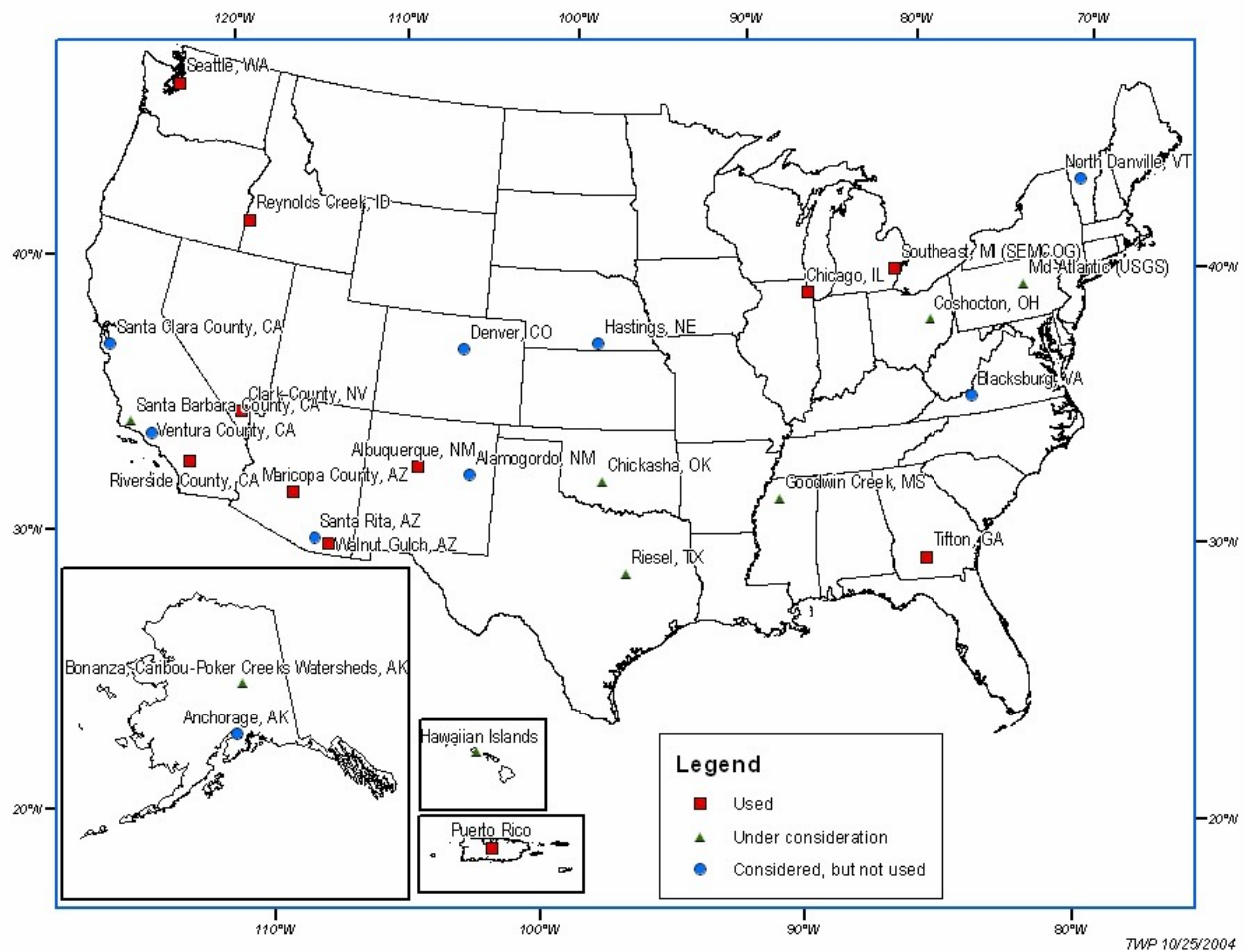
3.3 Areal Reduction Factors

Progress continues in the development of geographically-fixed Areal-Reduction-Factor (ARF) curves for basin area sizes of 10 to 400 square miles. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 continues and is 90% complete.

An additional study area (Santa Barbara County, CA) has been added to the list of areas that could be used to develop the final set of ARF curves. Quality control is being performed and will be completed shortly on the precipitation data from this site. Two other study areas (Ventura County, CA and Chickasha, OK) are also being considered. The Blacksburg, VA study area has been eliminated as one of the sites to be analyzed because it lacks sufficient station density.

There are currently 12 study areas located throughout the conterminous U.S., Hawaii, and Puerto Rico that have been quality controlled, processed and ready for ARF analysis (see Figure 4). The “not used” study areas indicated in Figure 4 were considered but judged inadequate for the study due to poor data, limited or no metadata, or other problems. The set of ARF curves developed for each study area used will be tested for differences to determine if a single set of ARF curves can be used for the entire U.S. as is the case today or whether separate curves for different regions of the country are more appropriate.

Figure 4: Map of ARF study areas



4. Issues

4.1 Funding Becomes Available for Fiscal Year 2005 (FY05)

Funding has become available for FY05 from the US Army Corps of Engineers and NWS sources. Therefore, we anticipate work will begin on the Hawaii Precipitation Frequency Project in May 2005. However, funding for FY06 must be maintained at the same level in order to meet the schedule set below.

4.2 Recent and Upcoming Presentations

Presentations by HDSC, include the following:

- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the California Extreme Precipitation Symposium in Davis, CA on July 1, 2004
- An update of the Ohio River Basin and Surrounding States Precipitation Frequency Project progress at the 84th Meeting of the Ohio River Basin Commission on July 14, 2004
- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the Colorado Association of Stormwater and Floodplain Managers (CASFM) Annual Conference in Glenwood Springs, Colorado on September 23-24, 2004

5. Projected Schedule and Remaining Tasks

The following list provides a tentative schedule with completion dates. Brief descriptions of tasks that will be worked on during the next few quarters are also included in this section.

Data Collection and Quality Control [July 2005]
L-Moment Analysis/Frequency Distribution [November 2005]
Trend Analysis [September 2005]
Temporal Distributions of Extreme Rainfall [December 2005]
Spatial Interpolation [February 2006]
Peer Review of Spatially Distributed Estimates [March 2006]
Precipitation Frequency Maps [May 2006]
Web Publication [May 2006]

Areal Reduction Factors [January 2005]

5.1 Data Collection and Quality Control.

Starting in May 2005 we will obtain appropriate NCDC and other available data and then start the quality control and testing of the regionalization. The estimation of the appropriate probability distribution functions and the parameterization of these functions as well as the spatial interpolation steps will be done for all islands as a group to ensure consistency in this part of the process.

5.2 Areal Reduction Factors (ARF)

Computations for the ARF curves will be completed in the next quarter for 12 areas. The resulting curves will be tested for differences to determine if a single set of ARF curves is applicable to the entire U.S. or whether curves vary by region.

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